

**B.Tech VII Semester Syllabi – Mechanical Engineering**

B.Tech. Mech. Batch Sem-VII [July-Dec 2019]						
Sr. No.	Course Code	Course Name	L	T	P	Credits
1		Program Elective VII-1	3	0	0	3
2		Program Elective VII-2	3	0	0	3
3		Open Elective – 3	3	0	0	3
4	ME3PC01	Project Work I	0	0	8	4
5	ME3PC03	Industrial Training	0	2	0	2
6		Total	9	2	8	15
		Total Contact Hours	19			

**Program Elective VII – 1**

ME3EI07 TQM & SQC

ME3EL03 Robotics Engineering

ME3EE07 Bio and Solid Waste Management

**Program Elective VII – 2**

ME3EI01 Operations Management

ME3EL04 Manufacturing Automation

ME3EE06 Utilization of Solar Energy

**Open Elective – VII – 3**

1 OE00047 Advance Machining Processes

2 OE00048 Supply Chain Management

**Specialization**

1. Industrial and Production Engineering
2. CAD/CAM/CAE
3. Energy Technology
4. Mechatronics



Course Code	Course Name	Hours per Week				Total
		L	T	P	Credits	
ME 3102	TQM & SPC	1	0	0	1	3

#### UNIT I

Introduction: Introduction to quality, Definition, Dimensions of quality, Goal post and Reason where of quality, Types of quality management, quality of design, performance, and performance, Quality cost and its components.

#### UNIT II

TQM: TQM definition, Evolution of TQM, Key principles of TQM, Benefits and limitations of TQM, Barrier to implementing TQM, Contribution of various quality gurus (W. Edwards Deming, P.D.A. cycle and 14 point philosophy, Taguchi's Loss function, JDOE.)

#### UNIT III

SQC: Process flow charting process, definition, uses of variation and feedback, Process control experiment, rules of adjustment and its effect, measures of central tendency, variability and changes, sampling, size and control, sigma theorem, control chart structure, process plotting and stability, study of out-of-control evidences, defect detection and prevention, use of control charts in evaluating past, present and future trends, attribute and variable control charts, count and classification charts, construction and interpretation of  $\bar{p}$ ,  $\bar{np}$ ,  $\bar{c}$  and  $\bar{u}$  charts,  $\bar{X}$  and  $R$  charts, and  $s$  charts.

#### UNIT IV

Quality Improvement Tools and Techniques: Pareto's chart, Histogram, Ishikawa's Diagram, Flow charts, scatter diagrams, construction and applications, Benchmarking and its types, Benchmarking process, Quality Function Deployment (QFD), KANO model, six sigma concept, methodology, application to manufacturing.

#### UNIT V

Quality Standards: acceptance sampling & operational characteristics curve (OC curve) consumer and producer's risk, AQL, LTPD, sampling plans (single, double) Quality Circles, awarding, roles and responsibilities Quality standards, introduction to ISO 9001-2000 series, certification process, benefits, ISO 14000, Conformance to specification, quality assurance, quality audits and its types.

#### Text Books:

1. Gilson L.G. Oppenheimer, Quality management, TMEI
2. Total Quality Management by Kalarita, Arora
3. Statistical Quality Control by M. Mahajan

#### Reference Books:

1. Goynia PM, Juran's Quality Planning and Analysis TMEI
2. Crosby Philip: Quality is still free, New Amer Library
3. Total Quality management by Besterfield D.H., Pearson Education

Course Code	Course Name	Hours Per Week			Total
		L	T	P	Credits
ME3EL03	Robotics Engineering	3	0	0	3

#### UNIT I

**Introduction:** Definitions, Laws of Robotics, Historical Development, Classification of Robots, Robot Anatomy, Robot Manipulator, Basic Robot Configurations and their Relative Merits and Demerits, the Wrist & Gripper Subassemblies, Work Volume.

#### UNIT II

**Kinematics of Robotic Manipulator:** Introduction, Direct Kinematics problem, Rotation matrix, Composite Rotation matrix, Homogenous Transformations, Robotic Manipulator Joint Co-Ordinate System, D-H Representation & Displacement Matrices for Standard Configurations, Inverse Kinematics problems.

#### UNIT III

**Dynamics of Robotic Manipulators:** Introduction, Preliminary Definitions, Generalized Robotic Coordinates, Jacobian for a Two link Manipulator, Euler Equations, Lagrangian Equations of motion, Lagrange-Euler Formulation of Robotic Manipulators.

#### UNIT IV

**Robot End Effectors & Sensors:** Introduction, Types of End Effectors, Mechanical Grippers, Other types of Grippers, Tools as End Effectors, Considerations in Gripper Selection & Design, Transducers & Sensors, Types of Sensors, Tactile, Proximity, Range & Miscellaneous Sensors.

#### UNIT V

**Robot Programming & Languages:** Introduction, Methods of Robot Programming, Lead through Programming Methods, Motion Interpolation, Wait, Signal & Delay Commands, Branching, Textual Robot Languages, Robot Language Structure, Motion Commands, End Effect or Commands, Sensor Commands, Program Control & Subroutines.

#### Text Books:

1. Fu, Lee and Gonzalez, Robotics, control vision and intelligence- McGraw Hill International
2. John J. Craig, Addison, Introduction to Robotics- Wesley Publishing
3. S K Saha, Introduction to Robotics, Tata McGraw-Hill.

#### References Books:

1. Yoram Koren, Robotics for Engineers - McGraw Hill International
2. Saeed Niku, Introduction to Robotics: Analysis, Control, Applications John Wiley & Sons.
3. R K Mittal, I J Nagrath, Robotics and control, Tata McGraw Hill.

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Course Code	Course Name	Hours per Week			Total
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ME3EE07	Bio and Solid Waste Management	3	0	0	3

#### UNIT I

**Introduction:** Sources and engineering classification, characterization, generation and quantification; Objectives, principles, functional elements of solid waste management system  
Regulatory aspects of solid waste management, major problems.

#### UNIT II

**Waste Generation:** Rate of generation, frequency, storage and refuse collection, physical and chemical composition, quantity of waste, engineering properties of waste, prediction, Collection, Segregation and Transport: Handling and segregation of wastes at source.

#### UNIT III

**Waste Minimization:** 4R- reduce, recover, recycle and reuse, case study, guidelines Treatment Methods -Refuse processing technologies. Mechanical and thermal volume reduction. Biological and chemical techniques for energy and other resource recovery

#### UNIT IV

**Disposal Methods:** Impacts of open dumping, site investigation and selection, sanitary land filling - Types, geotechnical considerations, design criteria and design, Role of various organizations in Solid Waste Management: Governmental, Non - Governmental, Citizen Forums

#### UNIT V

**Recent Developments in Solid Wastes Reuse and Disposal:** Power Generation, Blending with construction materials and Best Management Practices (BMP). Community based waste management, Waste as a Resource concept, Public private partnership (PPP)

#### Text Books:

1. Mantell C.L., "Solid Waste Management", John Wiley
2. Peavy, Rowe and Tchobanoglous, "Environmental Engineering", McGraw Hill.
3. Paul T Willams, "Waste Treatment and Disposal", John Wiley and Sons

#### Reference Books:

1. Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal
2. George Tchobanoglous and Frank Kreith "Handbook of Solidwaste Management", McGraw Hill, New York
3. Flintoff F., "Management of Solid Wastes in Developing Countries", WHO

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Course Code	Course Name	Hours per Week			Total
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ME3EI01	Operations Management	3	0	0	3

#### UNIT I

**Introduction:** Operations Management: Introduction and overview, Operations Management Strategy framework, Responsibilities of operation manager Understanding similarities and difference among goods and services, Historical evolution of operations management-Changes & Challenges.

#### UNIT II

**Product Development:** Operations strategy, Product Strategy and integrated product development, Process Strategy, Systematic approach to capacity planning, Capacity Decisions, Facilities Location Strategies, BPO, DFM, DFE, 3'S

#### UNIT III

**System Design:** Facilities Layout and Material Handling Strategy, Group Technology, Flexible manufacturing system, Assembly line balancing, Project Management-CPM PERT, Line of Balance (LOB). Traditional v/s Concurrent Design, form & functional design, simplification & standardization

#### UNIT IV

**Planning and Managing Operations:** Purchasing, vendor selection and material management, Just-in-Time Systems, MPS. Materials Requirement Planning, MRP II and ERP Aggregate Operations Planning, Product structure tree,

#### UNIT V

**Advance Operation Management:** Service Operations Management, Lean systems, Constraint management – TOC, Computer integrated manufacturing, Analytical tools for decision support system (DSS) for operations management, Kanban and CONWIP, shop floor controls, Kaizen.

#### Text Books:

1. Chary S N, Production and Operations Management, Tata Mc Graw Hill
2. Chase, Jacobs and Aquilano, Operations Management for Competitive advantages, Tata Mc Graw Hill
3. Everett Adam, Ronald J Ebert, Production and Operations Management Prentice Hall

#### Reference Books:

1. Joseph G. Monks, Operations Management Theory and Problems, Mc. Graw Hill.
2. William J Stevenson, Operations Management Concepts, McGraw Hill
3. Norman Gaither, Greg. Frazier, Operation Management, Thomson

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
ME3EL04	Manufacturing Automation	3	0	0	3

#### UNIT I

**Introduction to Automation:** Automation, the basic elements and their description, other advanced functions of automation, types of automation, levels of automation, reasons of automation, automation principles and strategies – USA principle, ten strategies of automation, automation migration strategy.

#### UNIT II

**Production Systems:** Production system and its types – low, medium and high, manufacturing support system, reasons of manual labor in production systems, types of manufacturing operations, product- production relationship- quality vs quantity, product and part complexity, capabilities and limitations of manufacturing plant, production concepts and mathematical models.

#### UNIT III

**Industrial Control Systems:** Automation in continuous and discrete product industries, continuous control system- regulatory, feed forward, steady state optimization, adaptive, discrete control system- event and time driven control, computer process control – types, control requirements and forms of computer control, signal conversion- analog to digital and vice versa, discrete control using programmable logic controller (PLC) - components of PLC and a few examples of ladder logic diagrams

#### UNIT IV

**Flexible Manufacturing Systems:** Limitations of conventional manufacturing, need for FMS, definition, types, components, layout and configuration of FMS, benefits and limitations of FMS, computer control system in FMS, automated handling and transport system – types of handling systems, AGV and its types, applications, guidance technologies automated storage/retrieval - performance of storage system and location strategies, automated storage and retrieval system AS/RS – objectives, types and applications of automated storage, components of AS/RS,

#### UNIT V

**Automated Inspection:** Types of inspection, inspection accuracy, inspection vs testing, automated inspection, inspection during manufacturing, contact vs non-contact inspection techniques, Coordinate measuring machine – construction and types based on structure, types of CMM controls and programming methods, CMM applications and benefits, Machine vision – basic steps and applications

#### Text Books:

1. Mikell P. Groover, "Automation, Production Systems and Computer Integrated Manufacturing, Pearson Education.
2. P Radhakrishnan, S Subramanyan, V Raju, "CAD/CAM/CIM, New Age Publication
3. Vikash Sharma, "Fundamental of CAD/CAM/CIM", S K Katariya and Sons

**Reference Books:**

1. H K Shivanand, M M Benal, V Koti, "Flexible Manufacturing System" New Age International
2. B R Mehta, Y J Reddy, "Industrial Process Automation Systems", Elsevier Science
3. Robert J Hocken, Paulo H Pereira, "Coordinate measuring Machines and Systems", CRC Press

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Course Code	Course Name	Hours per Week			Total
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ME3EE06	Utilization of Solar Energy	3	0	0	3

#### UNIT I

**Basics of Solar Energy:** Brief History of solar energy utilization - Various approaches of utilizing solar energy - Blackbody radiation, Factors governing availability of solar energy on the earth; Estimation of average daily global solar radiation.

#### UNIT II

**Solar Cookers and Solar Driers:** Types of solar cookers; Solar box type solar cooker; SK type solar cooker (parabolic); Solar steam cooking system; Solar bowl cooking concentrators; Classification of solar driers; Active and passive solar energy driers

#### UNIT III

**Solar Energy Collectors:** Stationary collectors - flat plate collectors, compound parabolic collectors and evacuated tube collectors; Sun tracking concentrating collectors - parabolic trough collectors, Fresnel collectors, parabolic dish reflectors

#### UNIT IV

**Solar Water Heating Systems:** Passive solar water heating systems - Thermal siphon systems, integrated collector storage systems; Active solar water heating systems - Direct circulation systems, indirect water heating systems

#### UNIT V

**Photovoltaic Systems:** Semiconductors; Photovoltaic panels; Types of photovoltaic technologies; Equipment related to photovoltaic technology - batteries, invertors, charge controllers, peak power trackers

#### Text Books:

1. Kalogirou S, Solar Energy Engineering: Processes and Systems, Academic Press, USA
2. Sukhatme SP, Solar Energy: principles of Thermal Collection and Storage, Tata McGraw-Hill
3. Tiwari GN, Solar Energy-Fundamentals, Design, Modelling & Applications, Narosa

#### Reference Books:

1. Solar Engineering and Thermal Processes, J. A. Duffie and W.A. Beckman, John Wiley and sons.
2. Solar Energy, G. N. Tiwari, Narosa Publishing House
3. Garg HP and Prakash J, Solar Energy fundamentals & Applications, Tata Mc-Graw Hill.

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